

DATA SHEET



175 TMP

**Aluminum electrolytic capacitors
High Temperature solid electrolytic
SMD**

Product specification
File under BCcomponents, BC01

2001 Jul 05

Aluminum electrolytic capacitors

High Temperature solid electrolytic SMD

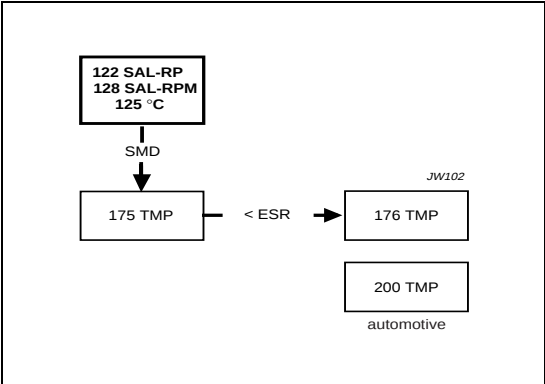
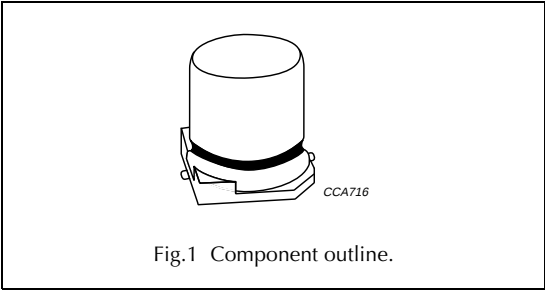
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FEATURES

- Polarized aluminum electrolytic capacitors SMD, solid electrolyte MnO₂
- Extremely long useful life, 20000 hours/125 °C
- Extended usable temperature range up to 175 °C
- Excellent impedance and ESR behaviour, at low and high temperature
- Charge and discharge proof, application with 0 Ω resistance allowed
- Reverse DC voltage up to 0.5 × U_R allowed
- AC voltage up to 0.8 × U_R allowed
- High shock and vibration capability
- High ripple current per volume in SMD.

APPLICATIONS

- SMD technology
- Smoothing, filtering, buffering
- Telecommunications, general industrial, EDP, high end power conversion
- Power supplies, SMPS for telecommunications.



QUICK REFERENCE DATA

DESCRIPTION	VALUE
Nominal case sizes (L × W × H in mm)	8 × 8 × 10 (0810 housing), 8 × 8 × 8 (0808 housing)
Rated capacitance range, C _R	1 to 68 μF
Tolerance on C _R	±20%
Rated voltage range, U _R	4 to 40 V
Category temperature range:	
U _R = 4 to 40 V	−55 to +85 °C
U _C = 4 to 25 V	−55 to +125 °C
U _C = 4 to 16 V	−55 to +175 °C
Endurance test at 175 °C	1 000 hours
Endurance test at 125 °C	10 000 hours
Useful life at 125 °C	20 000 hours
Useful life at 175 °C	2 000 hours
Useful life at 40 °C, I _g applied	>300 000 hours
Shelf life at 0 V, 125 °C	500 hours
Based on sectional specification	IEC 60384-4/EN130300
Climatic category IEC 60068	55/175/56

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175 TMPSelection chart for C_R , U_R and relevant nominal case sizes (L × W × H in mm)

C_R (μF)	U_R (V) at $T_{amb} = 125\text{ }^{\circ}C$						$T_{amb} = 85\text{ }^{\circ}$
	4	6.3	10	16	20	25	40
	U_R (V) at $T_{amb} = 175\text{ }^{\circ}C$						
	4	6.3	10	16	16	16	16
1	–	–	–	–	–	–	$8.0 \times 8.0 \times 10(8)$
1.5	–	–	–	–	–	–	$8.0 \times 8.0 \times 10(8)$
2.2	–	–	–	–	–	note 1	$8.0 \times 8.0 \times 10(8)$
4.7	–	–	–	–	$8.0 \times 8.0 \times 10(8)$	$8.0 \times 8.0 \times 10(8)$	–
6.8	–	–	–	$8.0 \times 8.0 \times 10(8)$	$8.0 \times 8.0 \times 10(8)$	$8.0 \times 8.0 \times 10(8)$	–
10	–	–	–	$8.0 \times 8.0 \times 10(8)$	note 1	$8.0 \times 8.0 \times 10(8)$	–
15	–	–	$8.0 \times 8.0 \times 10(8)$	note 2	note 2	–	–
22	–	–	$8.0 \times 8.0 \times 10(8)$	note 2	–	–	–
33	–	$8.0 \times 8.0 \times 10(8)$	note 2	–	–	–	–
47	$8.0 \times 8.0 \times 10(8)$	$8.0 \times 8.0 \times 10(8)$	note 2	–	–	–	–
68	$8.0 \times 8.0 \times 10(8)$	note 2	–	–	–	–	–

Notes

1. Available on request.
2. $T_{amb} = 125\text{ }^{\circ}C$, available on request.

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PACKAGING

Supplied in blister tape on reel. For general packaging information refer to data handbook BC01, section “Packaging”.

Table 1 Tape and reel dimensions

CASE CODE	PITCH P ₁ (mm)	TAPE WIDTH W (mm)	TAPE THICKNESS T ₂ (mm)	REEL DIA. (mm)	PACKAGING QUANTITY PER REEL
0808	16	24	11	380	500
0810					

MECHANICAL DATA

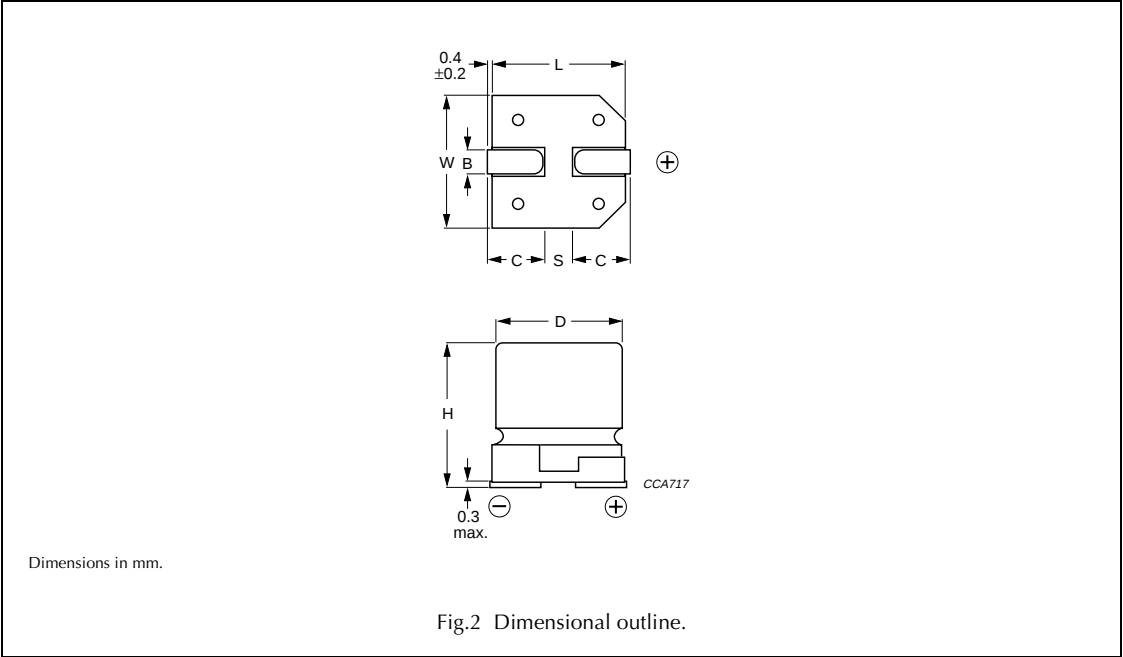


Table 2 Physical dimensions, mass and packaging quantities; see Fig.2

NOMINAL CASE SIZE L × W × H (mm)	CASE CODE	L _{max} (mm)	W _{max} (mm)	H _{max} (mm)	ØD (mm)	B _{max} (mm)	S (mm)	C (mm)	MASS (g)
8.0 × 8.0 × 8.0	0808	8.4	8.4	8.7	8.0	1	4.7	2.2 ±0.2	≈0.75
8.0 × 8.0 × 10	0810	8.4	8.4	10.5	8.0	1	4.7	2.2 ±0.2	≈0.8

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MOUNTING

The capacitors are designed for automatic placement on to printed-circuit boards.

Optimum dimensions of soldering pads depend amongst others on soldering method, mounting accuracy, print lay-out and/or adjacent components.

For recommended soldering pad dimensions, refer to Fig.3 and Table 3.

Soldering

Soldering conditions are defined by the curve, temperature versus time, where the temperature is that measured on the soldering pad during processing.

Resistant against 260 °C reflow temperature see Fig.4.

Any temperature versus time curve which does not exceed the specified maximum curves may be applied.

AS A GENERAL PRINCIPLE, TEMPERATURE AND DURATION SHALL BE THE **MINIMUM** NECESSARY REQUIRED TO ENSURE GOOD SOLDERING CONNECTIONS.

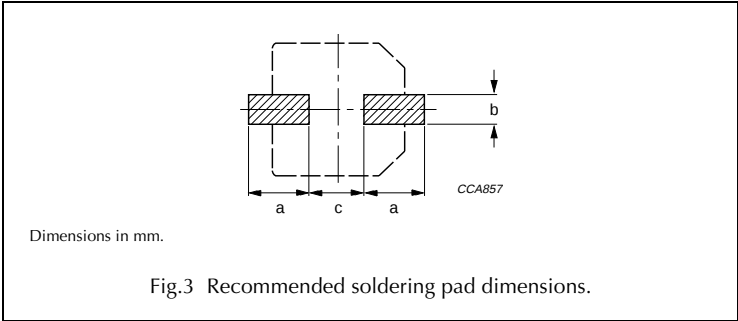
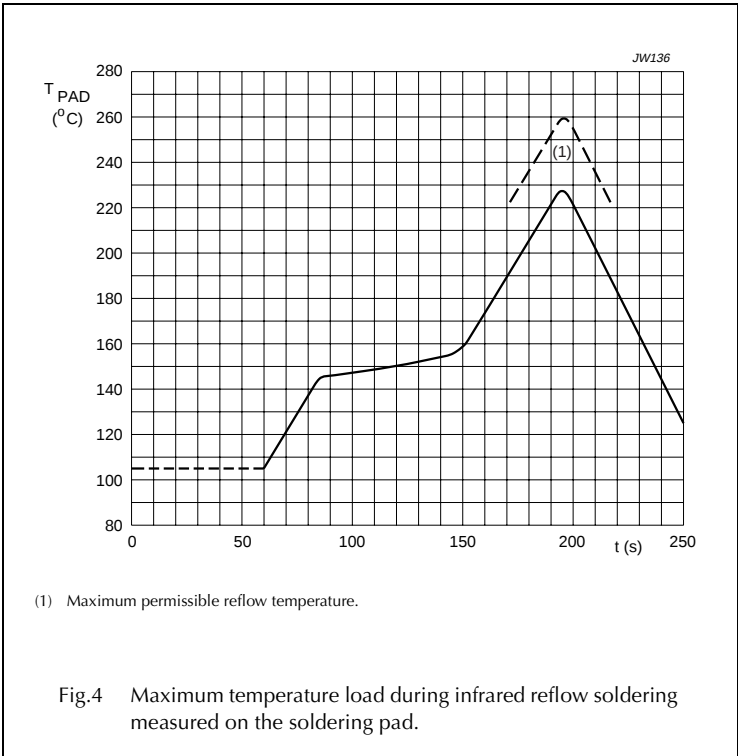


Table 3 Recommended soldering pad dimensions

CASE CODE	a (mm)	b (mm)	c (mm)
0808	3.0	2.5	4.0
0810			



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ELECTRICAL DATA

Unless otherwise specified, all electrical values in Table 4 apply at T_{amb} = 20 °C, Electrolytic capacitor 175 series
P = 86 to 106 kPa, RH = 45 to 75%.
47 µF/6.3 V; ±20%
Nominal case size:
8 × 8 × 10 mm; taped on reel
Catalogue number: 2222 175 63479.

Ordering example

SYMBOL	DESCRIPTION
C _R	rated capacitance at 100 Hz, tolerance ±20%
I _R	typical RMS ripple current no necessary DC voltage applied
I _{L5}	typical leakage current after 5 minutes at U _R
ESR	typical equivalent series resistance at 100 kHz
Z _{f res}	typical impedance at average resonance frequency

Table 4 Electrical data for 175 series

U _R (V)	U _C 125 °C (V)	U _C 175 °C (V)	C _R (µF)	NOMINAL CASE SIZE L × W × H (mm)	I _R 50 kHz 85 °C (mA)	I _R 100 kHz 40 °C (mA)	I _R >300 kHz 25 °C (mA)	I _R 100 kHz 175 °C (mA)	I _{L5} 5 min (µA)	TYP. ESR 50 kHz (Ω)	TYP. ESR 100 kHz (Ω)	TYP. ESR 300 kHz (Ω)	TYP. Z _{f res} (Ω)	TYP. f _{res} (MHz)
4	4	4	47	8.0 × 8.0 × 10(8)	1640	2319	2714	382	3	0.23	0.18	0.14	0.12	0.83
			68	8.0 × 8.0 × 10(8)	1854	2540	2931	419	5	0.18	0.15	0.12	0.11	0.65
6.3	6.3	6.3	33	8.0 × 8.0 × 10(8)	1804	2540	3061	419	4	0.19	0.15	0.11	0.1	0.71
			47	8.0 × 8.0 × 10(8)	1716	2459	2931	406	5	0.21	0.16	0.12	0.11	0.73
10	10	10	15	8.0 × 8.0 × 10(8)	999	1391	1692	229	3	0.62	0.5	0.36	0.25	2
			22	8.0 × 8.0 × 10(8)	1350	1786	2186	290	3	0.41	0.31	0.22	0.225	2
16	16	16	6.8	8.0 × 8.0 × 10(8)	624	863	1015	183	3	1.59	1.3	1	0.59	5.1
			10	8.0 × 8.0 × 10(8)	790	1107	1322	142	3	0.99	0.79	0.59	0.38	3.2
20	20	16	4.7	8.0 × 8.0 × 10(8)	562	778	939	128	2	1.96	1.6	1.17	0.63	6.4
			6.8	8.0 × 8.0 × 10(8)	609	844	995	179	2	1.62	1.31	1.02	0.59	5.1
25	25	16	4.7	8.0 × 8.0 × 10(8)	562	778	939	128	2	1.96	1.6	1.17	0.63	6.4
			6.8	8.0 × 8.0 × 10(8)	593	825	974	174	4	1.63	1.33	1.02	0.62	4.95
			10	8.0 × 8.0 × 10(8)	790	1107	1322	142	4	0.99	0.79	0.59	0.38	3.2
40	25	16	1	8.0 × 8.0 × 10(8)	388	557	692	92	2	4.1	3.12	2.15	0.86	9.6
			1.5	8.0 × 8.0 × 10(8)	447	651	813	107	2	3.1	2.28	1.56	0.74	7.1
			2.2	8.0 × 8.0 × 10(8)	468	669	821	110	2	2.82	2.16	1.53	0.74	7.5

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175 TMP**ORDERING INFORMATION****Table 5** Ordering information for 175 series

U_R (V)	U_C 125 °C (V)	U_C 175 °C (V)	C_R (μ F)	NOMINAL CASE SIZE L × W × H (mm)	CASE CODE	CATALOGUE NUMBER 2222
4	4	4	47	8.0 × 8.0 × 10	0810	175 62479
				8.0 × 8.0 × 8.0	0808	175 52479
			68	8.0 × 8.0 × 10	0810	175 62689
				8.0 × 8.0 × 8.0	0808	175 52689
6.3	6.3	6.3	33	8.0 × 8.0 × 10	0810	175 63339
				8.0 × 8.0 × 8.0	0808	175 53339
			47	8.0 × 8.0 × 10	0810	175 63479
				8.0 × 8.0 × 8.0	0808	175 53479
10	10	10	15	8.0 × 8.0 × 10	0810	175 64159
				8.0 × 8.0 × 8.0	0808	175 54159
			22	8.0 × 8.0 × 10	0810	175 64229
				8.0 × 8.0 × 8.0	0808	175 54229
16	16	16	6.8	8.0 × 8.0 × 10	0810	175 65688
				8.0 × 8.0 × 8.0	0808	175 55688
			10	8.0 × 8.0 × 10	0810	175 65109
				8.0 × 8.0 × 8.0	0808	175 55109
20	20	16	4.7	8.0 × 8.0 × 10	0810	175 68478
				8.0 × 8.0 × 8.0	0808	175 58478
			6.8	8.0 × 8.0 × 10	0810	175 68688
				8.0 × 8.0 × 8.0	0808	175 58688
25	25	16	4.7	8.0 × 8.0 × 10	0810	175 66478
				8.0 × 8.0 × 8.0	0808	175 56478
			6.8	8.0 × 8.0 × 10	0810	175 66688
				8.0 × 8.0 × 8.0	0808	175 56688
			10	8.0 × 8.0 × 10	0810	175 66109
				8.0 × 8.0 × 8.0	0808	175 56109
40	25	16	1	8.0 × 8.0 × 10	0810	175 67108
				8.0 × 8.0 × 8.0	0808	175 57108
			1.5	8.0 × 8.0 × 10	0810	175 67158
				8.0 × 8.0 × 8.0	0808	175 57158
			2.2	8.0 × 8.0 × 10	0810	175 67228
				8.0 × 8.0 × 8.0	0808	175 57228

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175 TMP**ADDITIONAL ELECTRICAL DATA**

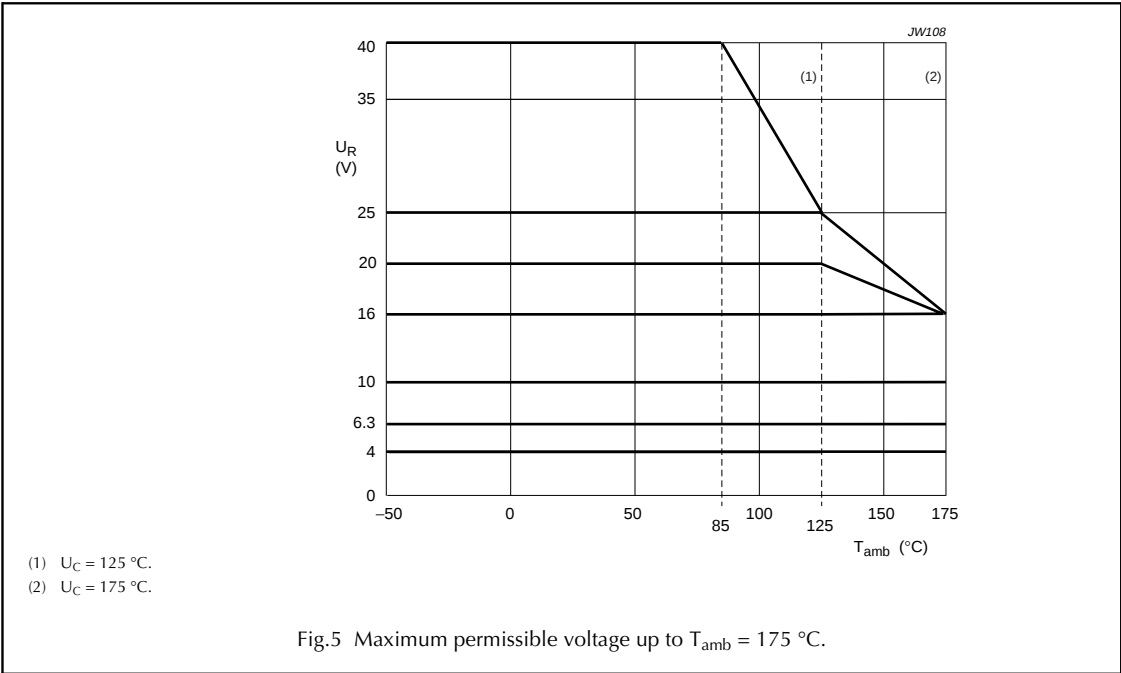
PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage		$U_s \leq 1.15 \times U_R$
Reverse voltage	$T_{amb} = 85\text{ °C}$:	
	at $U_R = 4$ to 16 V	$U_{rev} < 0.5\ U_R$
	at $U_R = 20\text{ V}$	$U_{rev} < 0.4\ U_R$
	at $U_R = 25$ to 40 V	$U_{rev} < 0.3\ U_R$
	$T_{amb} = 125\text{ °C}$:	
	at $U_R = 4$ to 16 V	$U_{rev} < 0.4\ U_R$
	at $U_R = 20\text{ V}$	$U_{rev} < 0.2\ U_R$
	at $U_R = 25$ to 40 V	$U_{rev} < 0.1\ U_R$
	$T_{amb} = 175\text{ °C}$:	
	at $U_R = 4$ to 16 V	$U_{rev} < 0.3\ U_R$
	at $U_R = 20\text{ V}$	$U_{rev} < 0.15\ U_R$
	at $U_R = 25$ to 40 V	$U_{rev} < 0.1\ U_R$
Maximum peak AC voltage	reverse voltage applied	$\leq 2\text{ V}$
Maximum peak AC voltage, without reverse voltage applied	$T_{amb} = 85\text{ °C}$:	
	at $f \leq 0.1\text{ Hz}$	$0.30 \times U_R$
	at $0.1\text{ Hz} < f \leq 1\text{ Hz}$	$0.45 \times U_R$
	at $1\text{ Hz} < f \leq 10\text{ Hz}$	$0.60 \times U_R$
	at $10\text{ Hz} < f \leq 50\text{ Hz}$	$0.65 \times U_R$
	at $f > 50\text{ Hz}$	$0.80 \times U_R$
	$85\text{ °C} < T_{amb} \leq 125\text{ °C}$:	
	at $f \leq 0.1\text{ Hz}$	$0.15 \times U_R$
	at $0.1\text{ Hz} < f \leq 1\text{ Hz}$	$0.22 \times U_R$
	at $1\text{ Hz} < f \leq 10\text{ Hz}$	$0.30 \times U_R$
	at $10\text{ Hz} < f \leq 50\text{ Hz}$	$0.32 \times U_R$
	at $f > 50\text{ Hz}$	$0.40 \times U_R$
	$125\text{ °C} \leq T_{amb} \leq 175\text{ °C}$:	
	at $f < 50\text{ Hz}$	$0.1 \times U_R$
	at $f > 50\text{ Hz}$	$0.2 \times U_R$
Inductance		
Equivalent series inductance (ESL)	case sizes $8 \times 8 \times 10(8)\text{ mm}$	typ. 9 to 14 nH
Dissipation		
Maximum power dissipation	case sizes $8 \times 8 \times 10(8)\text{ mm}$	$P = 350\text{ mW}$; $T_{amb} = 125\text{ °C}$
Current		
Maximum leakage current	after 5 minutes at U_R and $T_{amb} = 25\text{ °C}$	see Table 4

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Voltage



Ripple current (I_R)

Applying the maximum RMS ripple current given in Table 4 will cause a device temperature of 175 °C.

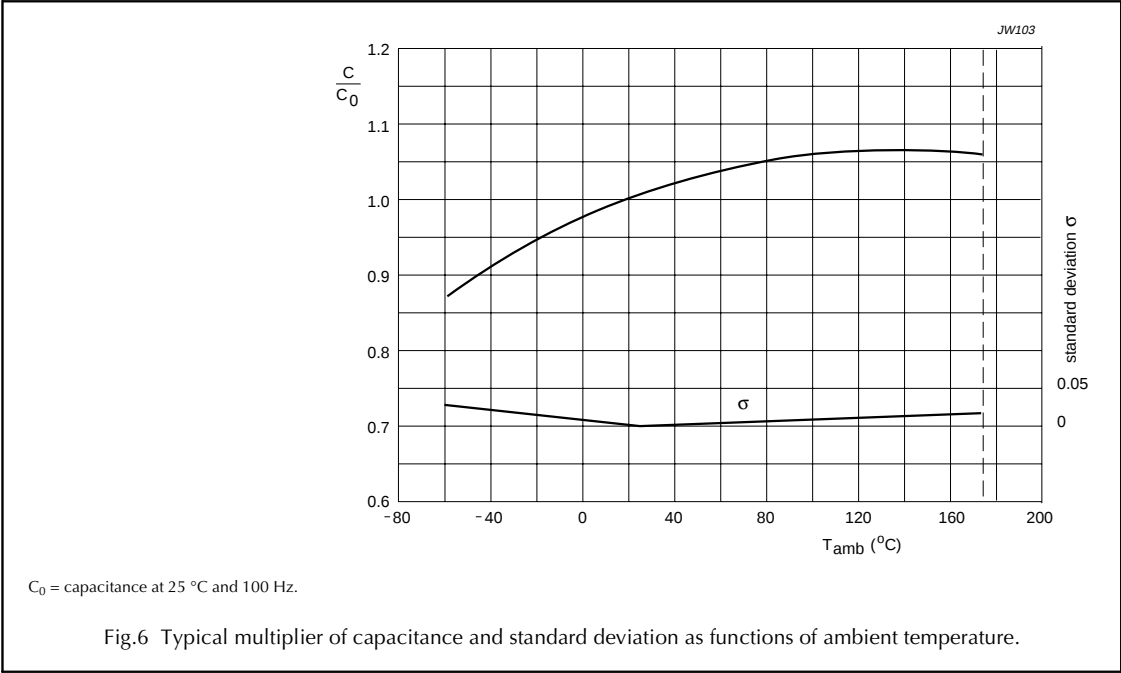
PARAMETER	T _{amb}					
	40 °C	85 °C	105 °C	125 °C	150 °C	175 °C
I _R multiplier; 100 kHz	1.0	0.87	0.78	0.67	0.5	0.16

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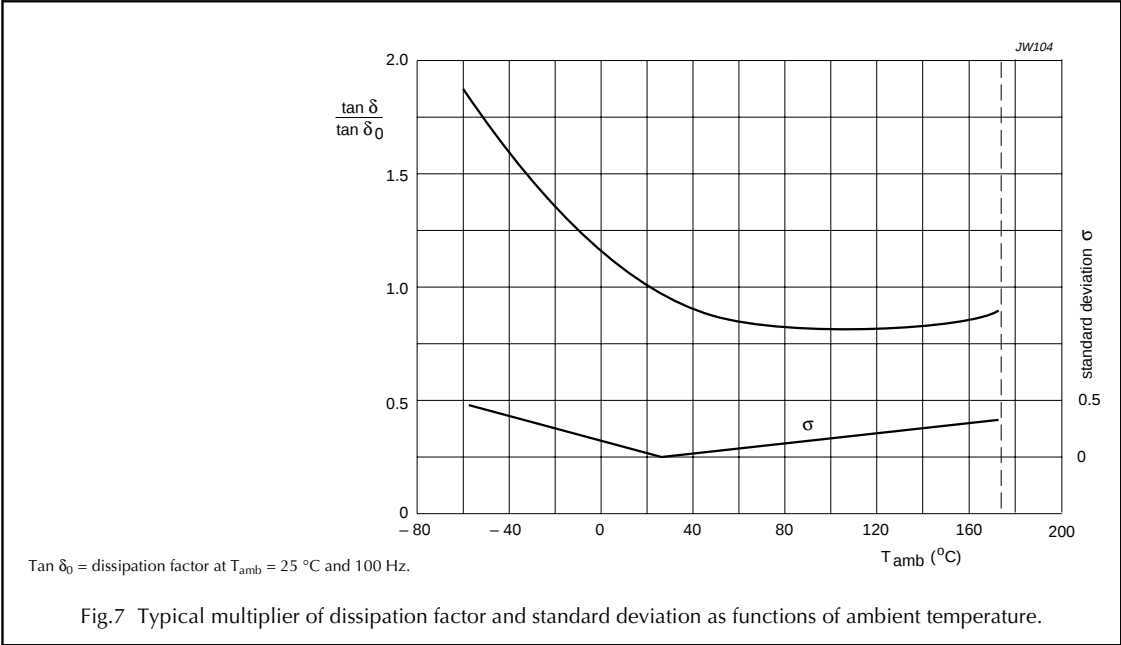
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Capacitance (C)



Dissipation factor ($\tan \delta$)

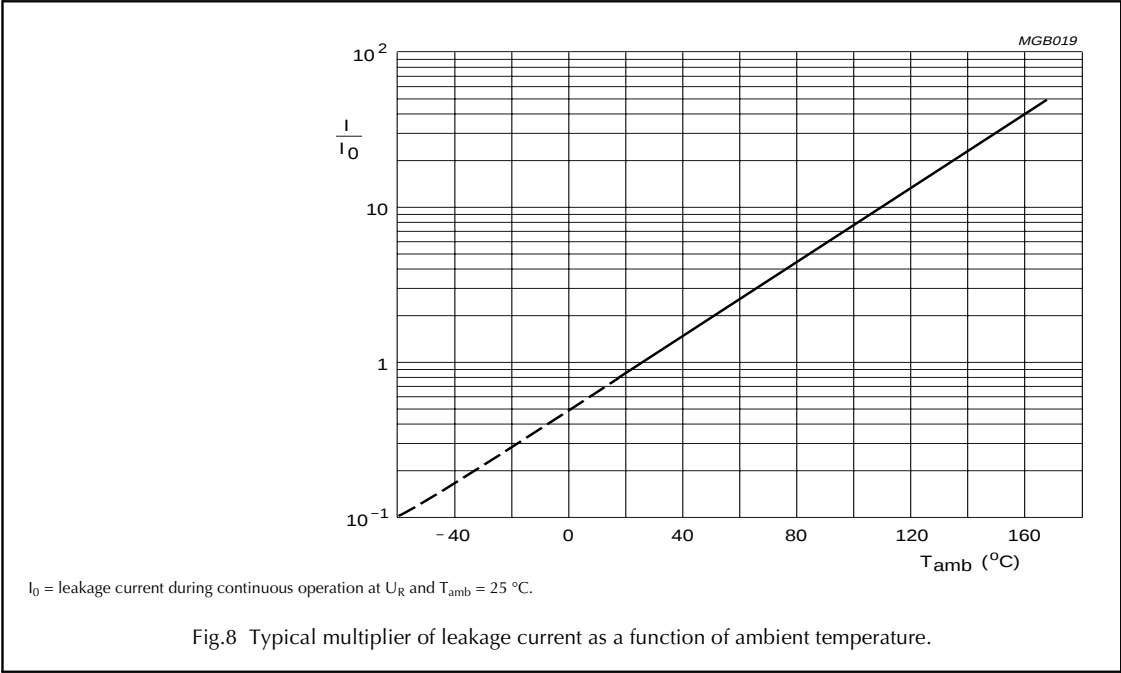


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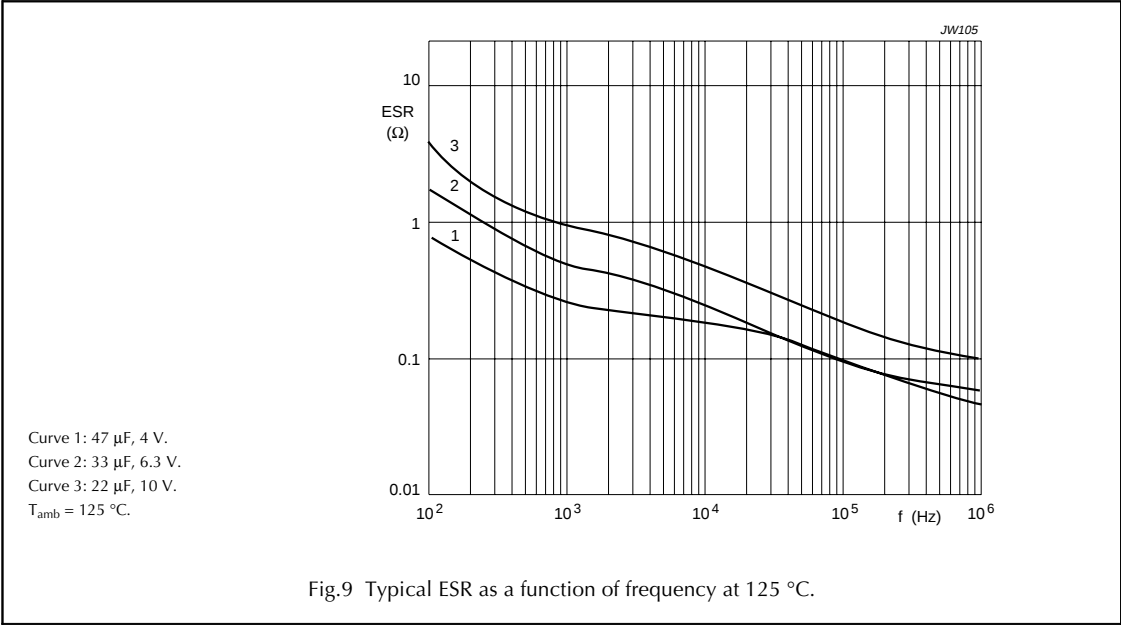
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Leakage current



Equivalent series resistance (ESR)



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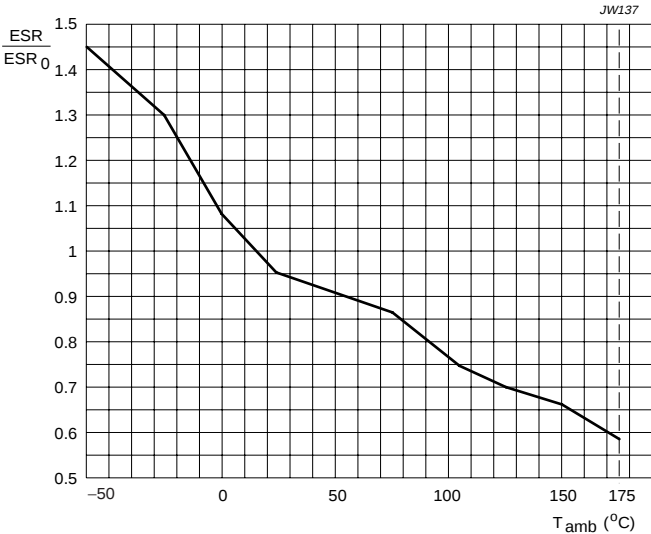


Fig.10 ESR correction multiplier as a function of temperature.

Impedance (Z)

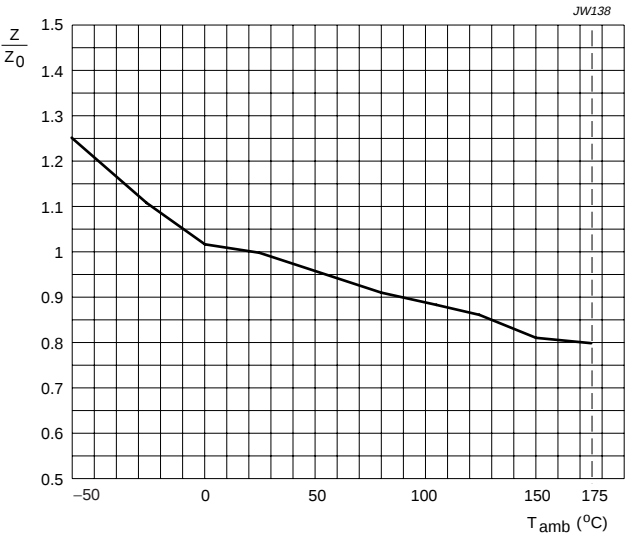


Fig.11 Z correction multiplier as a function of temperature.

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General tests and requirements are specified in data handbook BC01, section “Tests and Requirements”.

Table 6 Test procedures and requirements

TEST		PROCEDURE (quick reference)	REQUIREMENTS ⁽¹⁾
NAME OF TEST	REFERENCE		
Mounting	IEC 60384-18, subclause 4.3	shall be performed prior to tests mentioned below; reflow soldering; for maximum temperature load refer to chapter “Mounting”	$\Delta C/C: \pm 10\%$ $\tan \delta \leq \text{spec. limit}$ $I_{L2} \leq \text{spec. limit}$
Endurance	IEC 60384-4/ EN130300 subclause 4.13	$T_{\text{amb}} = 125\text{ }^{\circ}\text{C};$ $U_R = 4 \text{ to } 25\text{ V}$ with U_R applied; $U_R = 40\text{ V}$ with U_C applied; 10 000 hours $T_{\text{amb}} = 175\text{ }^{\circ}\text{C};$ $U_R = 4 \text{ to } 16\text{ V}$ with U_R applied; $U_R = 20 \text{ to } 40\text{ V}$ with U_C applied; 1 000 hours	$\Delta C/C: \pm 10\%$ $\tan \delta \leq 1.2 \times \text{spec. limit}$ $Z \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30302 subclause 1.8.1	$T_{\text{amb}} = 175\text{ }^{\circ}\text{C};$ I_R applied and: $U_R = 4 \text{ to } 16\text{ V}$ with U_R applied; $U_R = 20 \text{ and } 40\text{ V}$ with U_C applied; 2 000 hours	$\Delta C/C: \pm 15\%$ $\tan \delta \leq 1.5 \times \text{spec. limit}$ $Z \leq 1.5 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $< 1\%$
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	$T_{\text{amb}} = 85\text{ }^{\circ}\text{C};$ no voltage applied; 5 000 hours	$\Delta C/C: \pm 10\%$ $\tan \delta \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 1 \times \text{spec. limit}$
Charge and discharge	IEC 60384-4-2 subclause 9.21	10^6 cycles without series resistance: 0.5 s to U_R ; 0.5 s to ground	$\Delta C/C: \pm 5\%$ no short or open circuit, no visible damage
Solvent resistance	IEC 60068-2-45, test XA IEC 60653	immersion: 5 ± 0.5 minutes with or without ultrasonic at $55 \pm 5\text{ }^{\circ}\text{C}$ solvents: demineralized water and/or calgonite solution (20 g/l)	visual appearance not affected

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TEST		PROCEDURE (quick reference)	REQUIREMENTS ⁽¹⁾
NAME OF TEST	REFERENCE		
Vibration	IEC 60068-2-6 test Fc	10 to 2000 Hz; 1.5 mm or 20 g; 1 octave/minute; 3 directions; 1 sweep per direction; no voltage applied	no intermittent contacts no breakdown no open circuiting no mechanical damage $\Delta C/C: \pm 5\%$ $\tan \delta \leq 1.2 \times \text{spec. limit}$ $Z \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 1.5 \times \text{spec. limit}$
Shock	IEC 60068-2-27 test Ea	half-sine or sawtooth pulse shape; 50 g; 11 ms; 3 successive shocks in each direction of 3 mutually perpendicular axes; no voltage applied	no intermittent contacts no breakdown no open circuiting no mechanical damage $\Delta C/C: \pm 5\%$ $\tan \delta \leq 1.2 \times \text{spec. limit}$ $Z \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 1.5 \times \text{spec. limit}$
Bump	IEC 60384-4/ EN 130300 subclass 4.9	40 g; 2 directions; 4000 bumps total	no visible damage $\Delta C/C: \pm 5\%$ with respect to initial measurement
Passive flammability	IEC 60695-2-2	capacitor mounted to a vertical printed-circuit board, one flame on capacitor body; $T_{\text{amb}} = 20 \text{ to } 25 \text{ }^{\circ}\text{C}$; test duration = 20 s	after removing the test flame from the capacitor, the capacitor must not continue to burn for more than 15 s; no burning particles must drop from the sample

Note

1. Specification limits on request.

MARKING

- Rated capacitance (in μF)
- Rated voltage (in V)
- Black mark or ‘-’ sign indicating the cathode (the anode is identified by bevelled edges)
- Code indicating group number (V) HT
- Date code, in accordance with “IEC 60062”.